INSTALLATION MANUAL FOR THE SUN EARTH TPB—SERIES OF SOLAR PHOTOVALTAIC POWER MODULES

1、 Introduction

1.1 Ningbo Solar Electric Power Co,Ltd commenced manufacturing Sun Earth solar cells and modules in 1978. For more than twenty years company provides the highest quality Mono-crystalline Silicon modules in a range of sizes designed to meet the requirements of the users domestic and abroad. Our company has advanced technology and high quality products. The products conform to criterion of IEC61215, and has passed ISO 9001-2000、CE and TUV certification.

1.2 Solar Modules

The modules consist of a series of electrically interconnected crystalline silicon solar cells, which are permanently laminated within special solar EVA and encapsulated between a tempered glass cover plate and TPT. The entire laminate is secured within an anodized aluminum frame, which not only supply structural strength, but also supply electrical insulation and certain chemical protection. Therefore modules are long life and reliable.

1.3 Applications

SUN EARTH solar modules is a high-efficiency、long-life direct current power source. The modules are ideal to remote mountainous area、traffic light、water pumps、long-distance telecommunication systems and electricity station.

1.4 Note

1.4.1 Because of high voltage、high power of the solar array which is made of many modules, please take care of the safety of installation personnel. To reduce the risk of electrical shock or burns, modules may be covered with opaque material (e.g., Black cloth) during installation.

1.4.2 Installation personnel must be authorized. During installation follow operating requirement to avoid shocks or burns. Do not touch live terminals with bare hands. Use insulated tools for electrical connections.

1.4.3 Before installation, in order to make sure the requirements of installation and check. Installation personnel have to red installation manual and kinds of using instructions carefully (storage battery、charge controller、inverter)

1.4.4 In the process of installation and applying, artificially concentrated sunlight are not permitted to be directed on the modules or panels.

Silicon Solar Cell Module TPB156×156-60-P Electrical Parameters

Testing Condition：AM1.5 Ee=1000W/㎡ T=25℃±2℃

Electrical Characteristics							
Cell	Poly – Crystal Silicon						
No. of Cells and Connections	60 in Series						
Rated Maximum Power(W)	200	205	210	215	220	225	230
Voltage at Pmax(Vmp)	34.1	34.2	34.3	34.4	34.5	34.6	34.7
Current at Pmax(Imp)	6.90	7.02	7.15	7.27	7.39	7.52	7.64
Open-circuit Voltage(Voc)	43.1	43.2	43.4	43.5	43.6	43.7	43.8
Short-circuit Currnet(Isc)	7.60	7.70	7.80	7.89	7.98	8.07	8.16
Temperature Coefficients							
Open-Circuit Voltage(Voc)	-0.35%/℃						
Short-Circuit Currnet(Isc)	+0.05%/℃						
Voltage at Pmax(Vmp)	-0.4%/℃						
Current at Pmax(Imp)	+0.04%/℃						
Power (P_{max})	-0.42%/℃						
NOCT(20℃, 0.8KW/m^2, 1m/s)	45.5℃						
Maximum System Voltage	1000VDC						
Maximum Series Fuse Rating	16A						
Maximum Over-Current Rating	16A						
Bypass Diodes	Three 15A, 45V						
Junction Box	JHB-5; 1000VDC; 16A; IP65;						
Output Cables	2PfG 1169 ; PV1-F 1×4mm^2						
Connector	YF-1001; 1000VDC; 16A;						
Application Class	Class A						
Fire Resistance Rating	Class C						
Maximum Load Capacity	200Kg/㎡						
Maximum Hail Diameter@82.8Km/h	25mm						
Absolute Maximum Ratings							
Operating Temperature	- 40 to 185℉/-40 to +85 ℃						
Storage Temperature	- 40 to 185℉/-40 to +85 ℃						
Mechanical Characteristics							
Dimensions	1642mm×992mm×46mm						
Weight	20 kg						

2、Installation and Operation

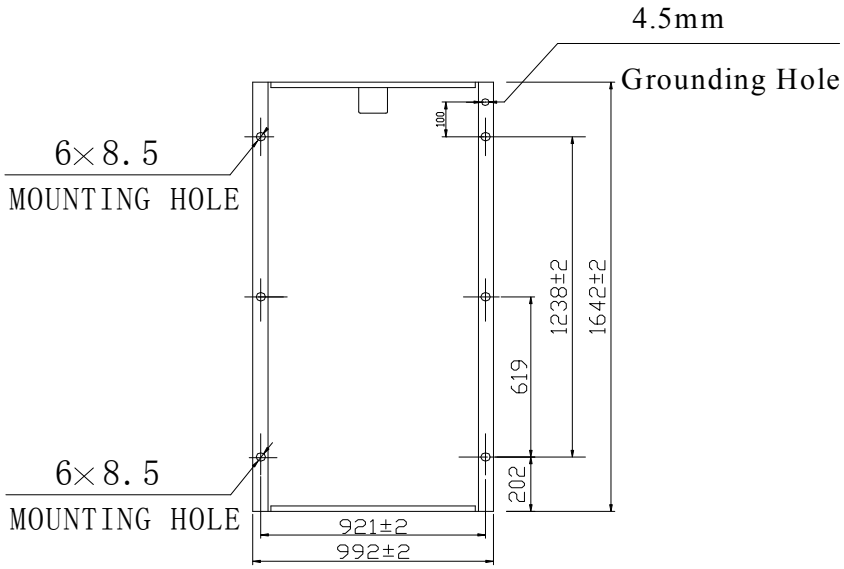
2.1 Only authorized and trained personnel should have access to these modules.

The system involves electricity, and can be dangerous if the personnel are not familiar with the appropriate safety procedures.

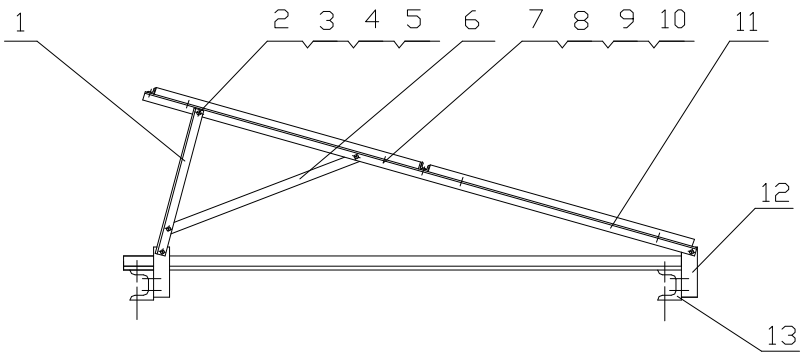
2.2 During installation, please take care of glass, which may be scratched and hit.

2.3 Solar modules' Installation position and range manner(in series, in parallel) on rack should according to constructional drawing(rack device drawing and power connection drawing). Solar array tilt angle should be adjusted according to regulation.

Note: Minimum 100 mm spacing between the module frames and surface of the mounting plate or ground is required to allow air to circulate behind the module.



TPB156×156-60-P
MODULE BACK SURFACE DRAWING



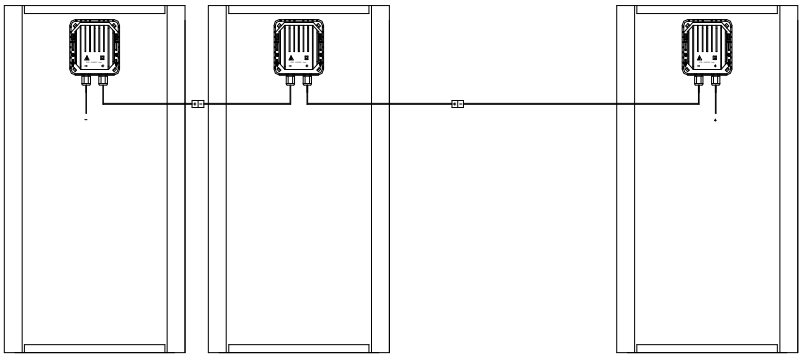
Installation structure recommendation (For reference only)

1. Angle Steel 40mm×40mm 2. Bolt M16×35 3. Nut M16 4. Flat M16

5. Spring- flat M16 6. Angle Steel 40mm×40mm 7. Bolt M16×16
8. Nut M6 9. Flat M6 10. Spring- flat M6
11. Angle Steel 40mm×40mm 12. Angle Steel 40mm×40mm
13. Though Steel 100mm

2.4 The modules have been evaluated for mounting using the 6 provided mounting holes (Diameter 8.5 mm) in two side of the frame, for a maximum positive or negative design loading of 2400Pa.

2.5 The output wire of the solar array、 blocking diode、 bypass diode must be connected correctly (bypass diode has connected in module).



TPB156×156-60-P
IN SERIES CONNECTION DRAWING

2.6 The module frame is made of anodized aluminum, and therefore corrosion can occur if the module is subject to a salt water environment with contact to a rack of another type of metal. If required, PVC or stainless washers can be placed between the solar module frame and support structure to prevent this type of corrosion.

2.7 The solar module frame must be attached to a support structure using M6 stainless steel hardware in a minimum of six places symmetrical on the solar module.

2.8 module support structures should be wind rated(system design).

2.9 If several modules are connected in series, the max. number of module(N)=Vmax system/Voc(at STC).

2.10 If several modules are connected in parallel, the max. number of module=2.

3、Grounding

Solar panels should be grounded independently after complete the installation, the operation should be done as following way:

3.1 Chose the correct grounded connection components according following table:

No.	Items	Specification	Requirement
1	Screw bolt	M4×20 mm	Stainless steel
2	Flat washer	M4×14 mm	Stainless steel
3	Double-color grounded cable	BVR 450/750V	2.5mm^2
4	Star washer	M4 mm	Stainless steel
5	Flange nut	M4 mm	Stainless steel

3.2 Drill the stainless steel screw bolt, flat washer, star washer and flange nut with exposed one end of the double-color ground cable into the grounding hole on the solar panels by cross screw driver. See grounded operation figure

3.3 Connect another end of the ground cable into the special grounded plate which should be confirmed been grounded well already.

Grounded operation figure

3.4 Use the multimeter to check whether the ground cable is connected well by two open-end terminal block between the solar panels and special grounded copperplate respectively.

3.5 Details for wiring in accordance with the NEC, and that the grounding method of the frame of arrays shall comply with the NEC, article 250.

3. 6 Grounding is achieved through securement to the array frame. The array frame shall be grounded in accordance with NEC Article 250.

4、Check and Accept

Check and accept accordance with electrical codes.

5、Site Selection

Choose a location where modules will receive maximum sunlight throughout the year. For example, in the Northern Hemisphere, the modules should face south. When choosing a site, avoid trees, building or obstructions which could cast shadows on the solar modules on the solar modules especially during the winter months.

6、Module Tilt Angle

Tilt angle is the angle between modules and horizon. In order to get the best tilt angle, as a rule, we should sacrifice superfluous power in summer and make up the shortage of the winter. According to the location of the sun in winter, refer to table for the recommended module tilt angle your site(see the below table)

Site latitude In Degrees	0°-15°	15°-25°	25°-30°	30°-35°	35°-40°	40°＋
Fixed Tilt Angle	15°	Same as latitude	latitude＋5°	latitude＋10°	latitude＋15°	latitude＋20°

7、Blocking diodes

Blocking diodes are typically placed between the battery and the PV module output to prevent battery discharge at night. Most PV charge regulators do have a nighttime disconnect feature.

8、Bypass Diodes

Partial shading of an individual in a 17.3 volt or 34.6 volt “series” string can cause power loss. Shading module will produce hot-pot. This hot pot intenerate the encapsulating polymer and make it turn to brown.

By having a bypass diode, the aboved current will bypass the shaded module in a series circuit, thereby minimizing module heating and array current losses.

Bypass Diodes Electrical Characteristics

Type		15SQ045	UNITS
Maximum Repetitive Peak Reverse Voltage	V_{RRM}	45	V
Maximum RMS Voltage	V_{RMS}	31.5	V
Maximum DC Blocking Voltage	V_{DC}	45	V
Maximum Average Forward Rectified Current	I_F(AV)	15	A
Peak Forward Surge Current 8.3ms single half sine-wave Superimposed on rated load (JEDEC method)	I_{FSM}	300	A
Peak Forward Voltage @15A DC(Note 1)	V_F	0.5	V
Maximum DC Reverse Current @ TA=25℃ at Rated DC Blocking Voltage @ TA=100℃	I_R	0.5 50	mA mA
Typical Thermal Resistance (Note 2)	$R_{\theta JA}$	2.2	℃/W
Junction temperature range at reduced reverse voltage VR≤80% VRRM VR≤50% VRRM In DC forward mode	T_J	-50 to +150 ≤175 ≤200	℃
Storage Temperature Range	T_{STG}	-50 to +150	℃
NOTES: 1. 300us Pulse Width. 2% Dudy Cyote. 2. Thermal Resistance Junction to Case.			

9、Maintenance

Sun Earth solar module id designed according to the rule of long life and free maintenance. Under most conditions, normal rainfall and wind is sufficient to keep the module glass clean. You should clean the class with a soft cloth using mild detergent and water. When clean the back, please don’t break the TPT.

10、Others

10.1 Rated electrical characteristics are within ±10% percent of measured values at Standard Test Conditions of 1000 W/m^2, 25℃ cell temperature and AM1.5 solar spectral irradiance.

10.2 Under certain conditions, a photovoltaic module is likely to produce more current and /or voltage than reported at standard test conditions. Accordingly, the value of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component standard values which are connected to the PV output. Refer to Section 690-8 of the National Electric Code for an additional multiplying factor of 1.25 which may be applicable.

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